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REPORT FOR CONSULTATION ON THE METROPOLITAN BALTIMORE INTRASTATE AIR QUALITY CONTROL REGION

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Consumer Protection and Environmental Health Service
National Air Pollution Control Administration
April, 1969

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PREFACE

The Secretary, Department of Health, Education, and Welfare is directed by the Air Quality Act of 1967 to designate "air quality control regions" as an initial step toward the establishment of regional air quality standards and the implementation of air quality control programs. In addition to listing the major factors to be considered in the development of region boundaries, the Act stipulates that the designation of a region shall be preceded by consultation with appropriate State and local authorities.

The National Air Pollution Control Administration, DHEW, has conducted a study of the greater Baltimore area, the results of which are presented in this report. The Region* boundaries proposed in this report reflect consideration of available and pertinent data; however, the boundaries remain subject to revision suggested by consultation with State and local authorities. Formal designation will be withheld pending the outcome of the meeting. This report is intended to serve as the starting point for the consultation.

The Administration is appreciative of assistance received either directly during the course of this study or indirectly during previous studies from the official air pollution agencies of the affected state and counties, and the Regional Planning Council of Baltimore.

*For the purposes of this report, the word region, when capitalized, will refer to the Metropolitan Baltimore Intrastate Air Quality Control Region. When not capitalized, unless otherwise noted, it will refer to air quality control regions in general.

INTRODUCTION

> "For the purpose of establishing ambient air quality standards pursuant to section 108, and for administrative and other purposes, the Secretary, after consultation with appropriate State and local authorities, shall, to the extent feasible, within 18 months after the date of enactment of the Air Quality Act of 1967 designate air quality control regions based on jurisdictional boundaries, urban-industrial concentrations, and other factors including implementation of air quality standards. The Secretary may from time to time thereafter, as he determines necessary to protect the public health and welfare and after consultation with appropriate State and local authorities, revise the designation of such regions and designate additional air quality control regions. The Secretary shall immediately notify the Governor or Governors of the affected State or States of such designation."
>
> Section 107(a), Air Quality Act of 1967

Air pollution, because of its direct relationship to people and their activities, is an urban problem. Urban sprawls often cover thousands of square miles; they quite often include parts of more than one State and almost always are made up of several counties and an even greater number of cities. Air pollution, therefore, also becomes a regional problem, and the collaboration of several governmental jurisdictions is prerequisite to the solution of the problem in any given area. Air quality control regions called for in the above-quoted section of the Air Quality Act of 1967 are meant to define the geographical extent of air pollution problems in different urban areas and the combination of jurisdictions that must contribute to the solution in each.

The regional approach set up by the Air Quality Act is illustrated in Figure 1. The approach involves a series of steps to be taken by Federal, State, and local governments, beginning with the designation of regions, the publication of air quality criteria, and the publication of information on available control techniques by the Federal Government. Following the completion of these three steps, the Governors of the States involved in a region designation must file with the Secretary within 90 days a letter of intent, indicating that the States will adopt within 180 days plans for the implementation, maintenance, and enforcement of those air quality standards in the designated air quality control regions.

The new Federal legislation provides for a regional attack on air pollution and, at the same time, allows latitude in the form which regional efforts may take. While the Secretary reserves approval authority, the States involved in a designated region assume the responsibility for developing air quality standards and an implementation plan which includes administrative procedures for abatement and control.

The basic objective in the designation of an air quality control region is that it be self-contained, i.e. that the transfer of air pollution out of or into a region is minimized. This objective recognizes the fact that an air quality control region cannot be delineated in a way to make it completely independent with respect to the air pollution problem. Because air pollutants can be carried long distances, the air over a region can be subjected occasionally or

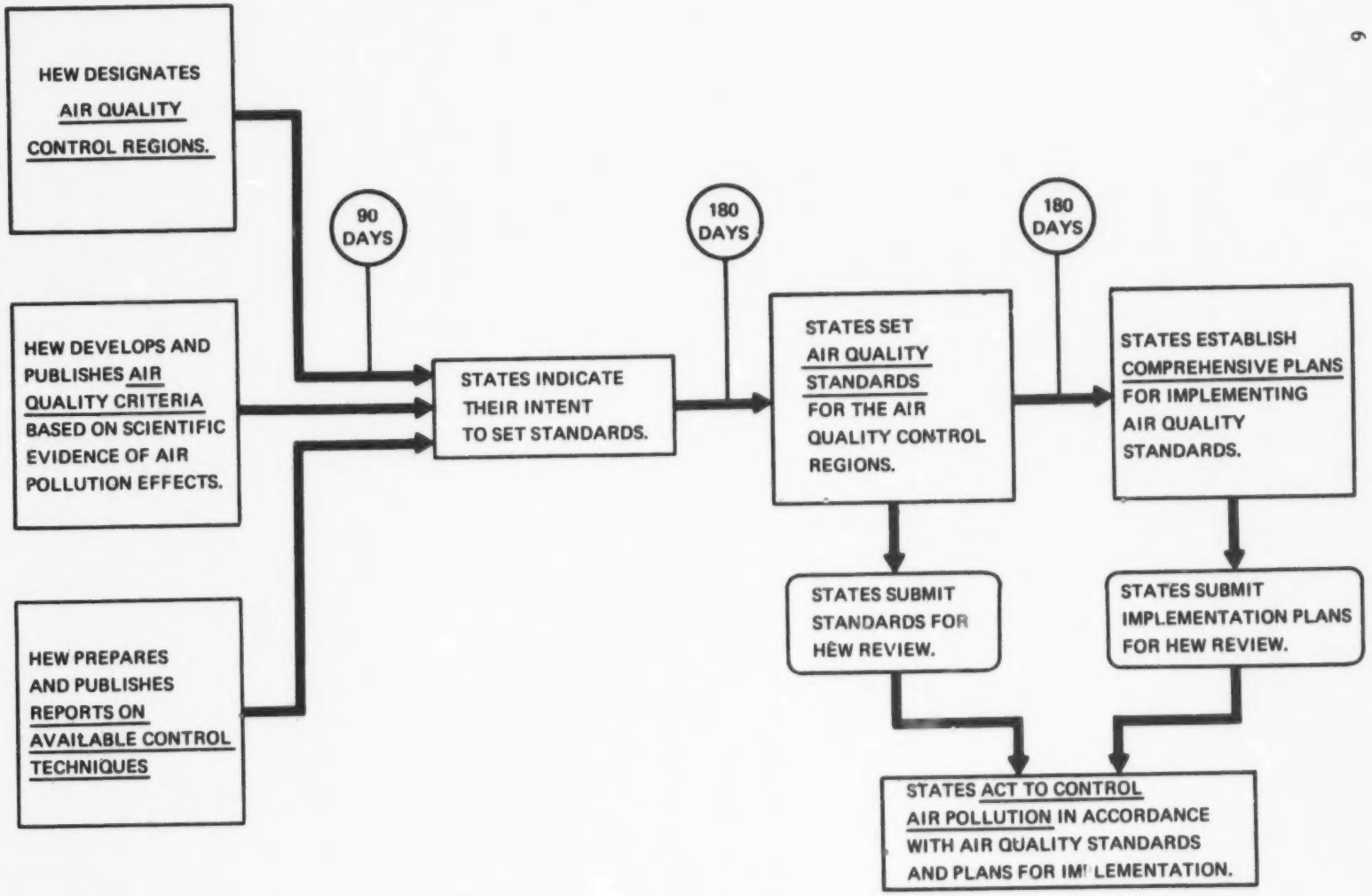
HEW DESIGNATES AIR QUALITY CONTROL REGIONS.
HEW DEVELOPS AND PUBLISHES AIR QUALITY CRITERIA BASED ON SCIENTIFIC EVIDENCE OF AIR POLLUTION EFFECTS.
HEW PREPARES AND PUBLISHES REPORTS ON AVAILABLE CONTROL TECHNIQUES
90 DAYS
STATES INDICATE THEIR INTENT TO SET STANDARDS.
180 DAYS
STATES SET AIR QUALITY STANDARDS FOR THE AIR QUALITY CONTROL REGIONS.
180 DAYS
STATES ESTABLISH COMPREHENSIVE PLANS FOR IMPLEMENTING AIR QUALITY STANDARDS.
STATES SUBMIT STANDARDS FOR HEW REVIEW.
STATES SUBMIT IMPLEMENTATION PLANS FOR HEW REVIEW.
STATES ACT TO CONTROL AIR POLLUTION IN ACCORDANCE WITH AIR QUALITY STANDARDS AND PLANS FOR IMPLEMENTATION.

FIGURE 1. FLOW DIAGRAM FOR ACTION TO CONTROL AIR POLLUTION ON A REGIONAL BASIS, UNDER THE AIR QUALITY ACT.

even frequently to trace amounts of pollution from other cities and individual sources located outside its boundaries. Under specific and episodic conditions such contributions can even reach significant quantities. The problem of a boundary designation is further compounded in that urban areas generally do not end abruptly but are surrounded by activities that can contribute to the pollution of the urban area as well as be the recipients of its generated pollution. Consideration of all these possibilities would result in regions substantially larger than is practical or even necessary to get to the brunt of the problem. The boundaries of regions, however, should encompass areas that contain sources that add significantly to the pollution load of the air as well as the areas that are significantly and continuously affected by it. For this purpose, the delineation of regional boundaries is based on evaluation of annual and seasonal air pollutant emissions and resultant ambient concentrations rather than those based on short-term and specific conditions.

The selection of regional boundaries should not be based solely on today's conditions and needs, but, perhaps more importantly, should give consideration to future development and growth of the area. Consideration should be given to prescribed metropolitan plans as well as the forecasted growth. Such considerations should result in the designation of regions that will contain the region-wide air pollutant source-receptor system for a number of years to come. This is not to say that the regional boundaries should remain stationary and unchanged. Periodic review of boundaries is desirable, and changes

in the boundary should be considered if conditions warrant.

The delineation of region boundaries solely on the basis of source locations and distributional patterns of ambient air pollution would most likely result in regions that do not follow any existing governmental boundaries, are difficult to define, and, more importantly, extremely difficult if not impossible to administrate. It is for this reason that existing jurisdictional entities are reviewed; wherein practical the boundary lines of a region include that combination of whole jurisdictions which encompasses the problem area. There can be exceptions to that philosophy, however. The presence of overly large jurisdictions, marked topographical features (mountains), or notable differences in development within a given jurisdiction may, in some cases, make it desirable to include only portions of some jurisdictions.

A region, then, will represent a balance between the various objectives discussed so far to the extent that any two of them lead to different conclusions. The strength of some factors over others may lead to region boundaries which exclude some sources of pollution that might affect the air quality of part or all of the nearby region under certain conditions. Even though the impact of such sources would probably be minimal, the implementation plan required under the Air Quality Act for the region should provide a methanism for the control of point sources that are located just beyond the region boundary. Such a provision would be consistent with the basic objective of providing desirable air quality within an area being designated as an air quality control region.

Figure 2 summarizes the procedure used by the National Air Pollution Control Administration for designating air quality control regions.

A preliminary delineation of the region is developed by bringing together two essentially separate studies--the "Evaluation of Engineering Factors" and the "Evaluation of Urban Factors."

The study of "Engineering Factors" indicates the location of pollution sources and the geographic extent of serious pollutant concentrations in the ambient air. Pollution sources are located by an inventory of emissions from automobiles, industrial activities, space heating, waste disposal, and other pollution generators. Pollutant concentrations in the ambient air are estimated from air quality sampling data by a theoretical diffusion model. When it exists, air quality sampling data is more reliable than the theoretical diffusion model results since the data is directly recorded by pollutant measuring instruments. Unfortunately, in many cases extensive air quality sampling data is unavailable in the rural areas surrounding an urban complex.

The study of "Urban Factors" encompasses all non-engineering considerations. It reviews existing governmental jurisdictions, current air pollution control programs, present concentrations of population and industry, and expected patterns of urban growth. Other non-engineering factors are discussed when they are relevant. As a whole, the study of urban factors indicates how large an air quality control region must be in order to encompass expected growth of pollution sources in the future. It also considers which group of governmental

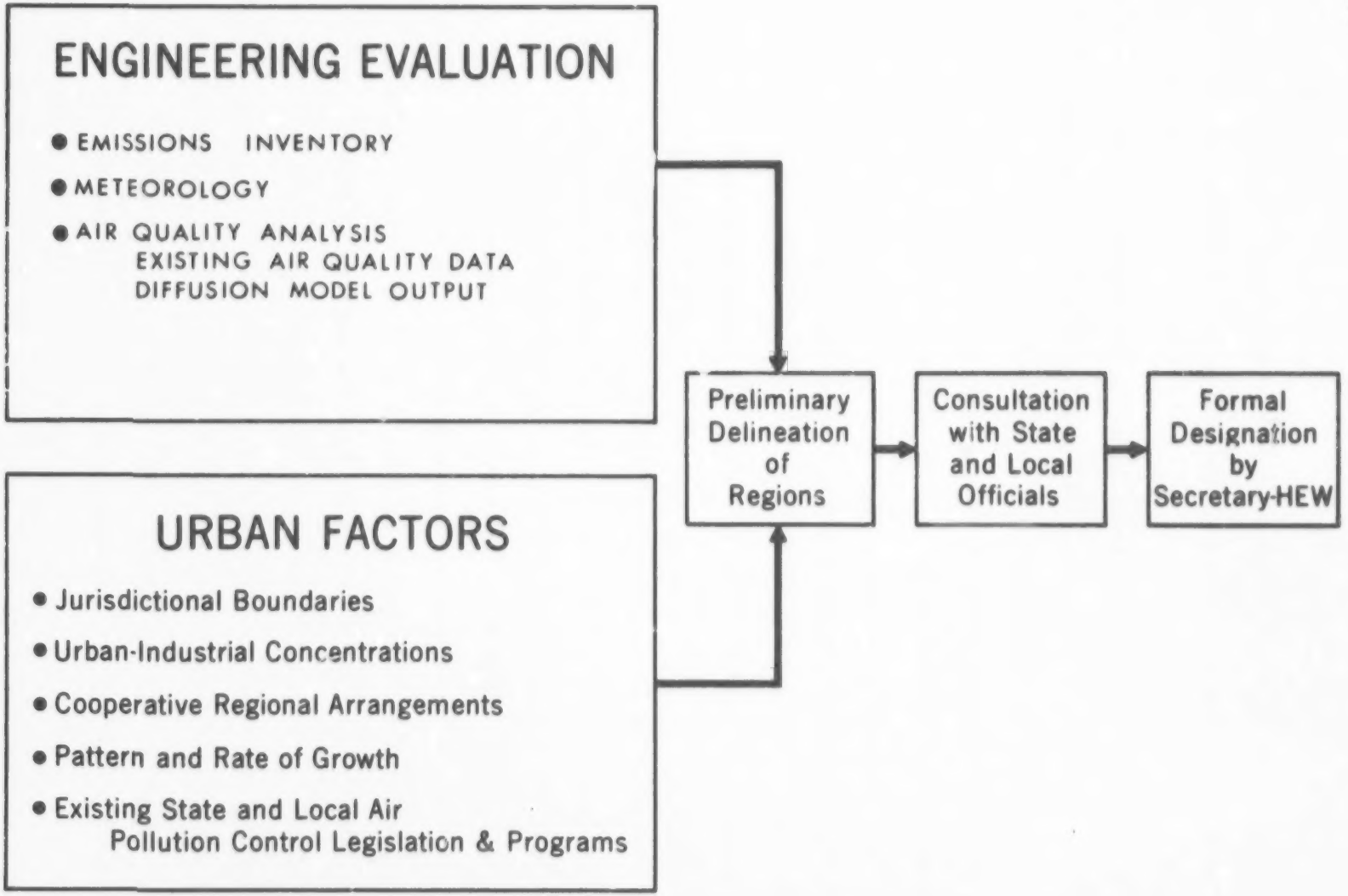
ENGINEERING EVALUATION
• EMISSIONS INVENTORY
• METEOROLOGY
• AIR QUALITY ANALYSIS
EXISTING AIR QUALITY DATA
DIFFUSION MODEL OUTPUT
URBAN FACTORS
• Jurisdictional Boundaries
• Urban-Industrial Concentrations
• Cooperative Regional Arrangements
• Pattern and Rate of Growth
• Existing State and Local Air Pollution Control Legislation & Programs
Preliminary Delineation of Regions
Consultation with State and Local Officials
Formal Designation by Secretary-HEW

Figure 2. Flow diagram for the designation of air quality control regions.

jurisdictions will most effectively administer a strong regional air quality control program.

The conclusions of the engineering study are combined with the results of the urban factors study to form the basis of an initial proposal for an air quality control region. As shown in Figure 2, the proposal is then submitted for consultation with State and local officials. After reviewing the suggestions raised during the consultation, the Secretary formally designates the region with a notice in the Federal Register and notifies the Governors of the States affected by the designation.

The body of this report contains a proposal for the boundaries of the Metropolitan Baltimore Intrastate Air Quality Control Region and supporting studies on engineering and urban factors. The report itself was intended to serve as the background document for the formal consultation with appropriate State and local authorities.

EVALUATION OF ENGINEERING FACTORS

The engineering evaluation for the Baltimore area was based on a study of meteorology, air pollutant emissions, and estimated and measured air quality levels. The emission inventory indicated the location of point and area sources, the quantity of pollutants emitted from these sources, and the resulting emission densities. These data were subsequently used in a diffusion model[1] to estimate air quality levels in the Baltimore area.

METEOROLOGY[2]

Baltimore and the surrounding area lie between the mild climates of the South and the more vigorous climates of the North, and adjacent to the modifying influences of the Chesapeake Bay and Atlantic Ocean to the east and the Appalachian Mountains to the west. The area is located near the average path of low pressure systems which move across the country, so changes in wind direction are frequent and contribute to the changeable character of the weather. The mountains to the west and bay and ocean to the east produce a net effect of producing a more equable climate compared with other continental locations further inland at the same latitude.

In the summer months, the area is under the influence of the large semi-permanent high pressure system centered over the Atlantic Ocean near 30° North Latitude. This system circulates warm, humid airmasses over the area from the Deep South.

Annual and seasonal wind roses for the Baltimore area are shown in Figure 3. In general, air pollution is transported towards the east-southeast from the emission sources in the industrial areas

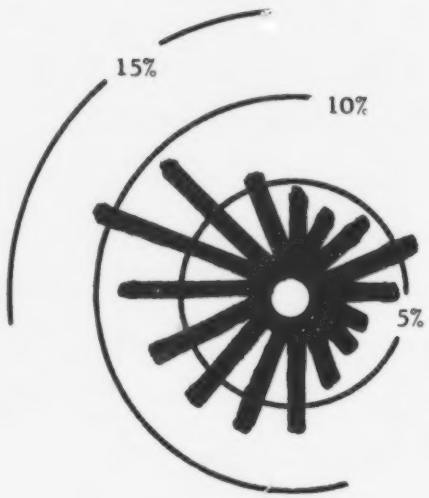

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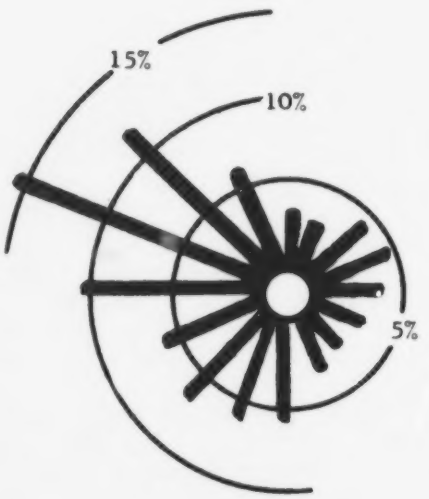
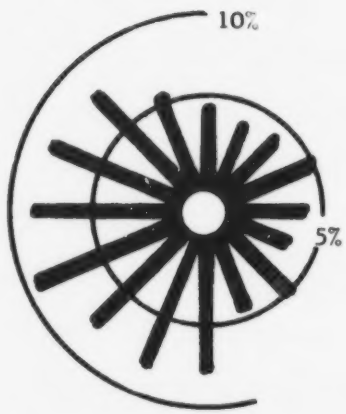
Figure 3. Percent Frequency of wind direction for various averaging times, based on 1951-1960 data.



WINTER



SUMMER

of the Baltimore area.

EMISSION INVENTORY

The National Air Pollution Control Administration conducted an inventory of air pollutant emissions for the Baltimore area. Three major pollutants--sulfur oxides, carbon monoxide, and suspended particulates--have been considered in previous studies by NAPCA to aid in designating air quality control regions. These three pollutants provide some measure of the general geographic extent of the overall problem. Sulfur oxides pollution levels illustrate the impact of fuel burning activities at stationary sources. Levels of carbon monoxide provide the best indication of the impact of gasoline-powered motor vehicles on the regional air pollution pattern. Particulate emissions indicate primarily the extent of industrial, power, incineration, and heating sources. Results of the emission inventory are tabulated in Table 1.

The Baltimore study included estimates for Baltimore City and County, and the counties of Carroll, Howard, Anne Arundel, and Harford.* The area was divided into the grid coordinate system shown in Figure 4. The estimated annual emissions of each of the three pollutants by grid zone were converted to average daily emissions for average annual, winter, and summer days.[3] Average seasonal and annual emission densities for each of the three pollutants in tons/square kilometer/day were determined by relating the total quantity of pollutants emitted per day in each of the grid zones to the land area of each zone. The resulting emission densities are shown graphically in Figures 5,6, and 7.

* Throughout this report, the "study area" refers to this group of jurisdictions.

TABLE I. POLLUTANT EMISSIONS BY SOURCE

CATEGORY AND POLITICAL JURISDICTION IN THE BALTIMOREAREA
(TONS/YEAR)

	Jurisdiction	Industrial	Commercial and Institution	Residential	Power Plants	Total Fuel	Industrial Processes	Transportation	Refuse Disposal	Total
Sulfur Oxides	Anne Arundel Co.	5,378	4,037	599	48,751	58,765	-	830	29	59,624
	Baltimore Co.	30,134	3,374	1,428	62,507	97,443	540	2,099	110	100,192
	Baltimore City	26,331	8,173	3,876	35,358	73,738	8,381	4,123	363	86,605
	Carroll Co.	2,064	1,616	306	-	3,986	225	208	5	4,424
	Howard Co.	1,903	611	282	-	2,796	-	144	4	2,944
	Harford Co.	1,019	178	121	-	1,318	-	277	8	1,603
	TOTAL	66,829	17,989	6,612	146,616	238,046	9,146	7,681	519	255,392
Particulates	Anne Arundel Co.	630	1,280	269	2,482	4,661	545	1,642	850	7,698
	Baltimore Co.	5,600	1,262	725	21,095	28,672	18,177	3,700	2,714	53,263
	Baltimore City	4,383	1,529	1,797	12,130	19,839	6,301	6,649	3,499	36,288
	Carroll Co.	296	1,934	163	-	2,393	1,379	349	177	4,298
	Howard Co.	218	133	119	-	470	136	238	155	999
	Harford Co.	120	127	49	-	296	43	468	320	1,127
	TOTAL	11,247	6,265	3,122	35,697	56,331	26,581	13,046	7,715	103,673
Carbon Monoxide	Anne Arundel Co.	58	1,123	319	294	1,794	-	112,059	2,888	116,741
	Baltimore Co.	402	838	861	381	2,482	-	247,527	8,944	258,953
	Baltimore City	473	1,006	2,915	212	4,606	10,035	342,412	648	357,701
	Carroll Co.	228	645	297	-	1,170	-	30,041	619	31,830
	Howard Co.	20	91	153	-	264	-	20,232	548	21,044
	Harford Co.	11	163	56	-	230	-	41,527	1,126	42,885
	TOTAL	1,192	3,866	4,601	887	10,546	10,035	793,798	14,775	829,154

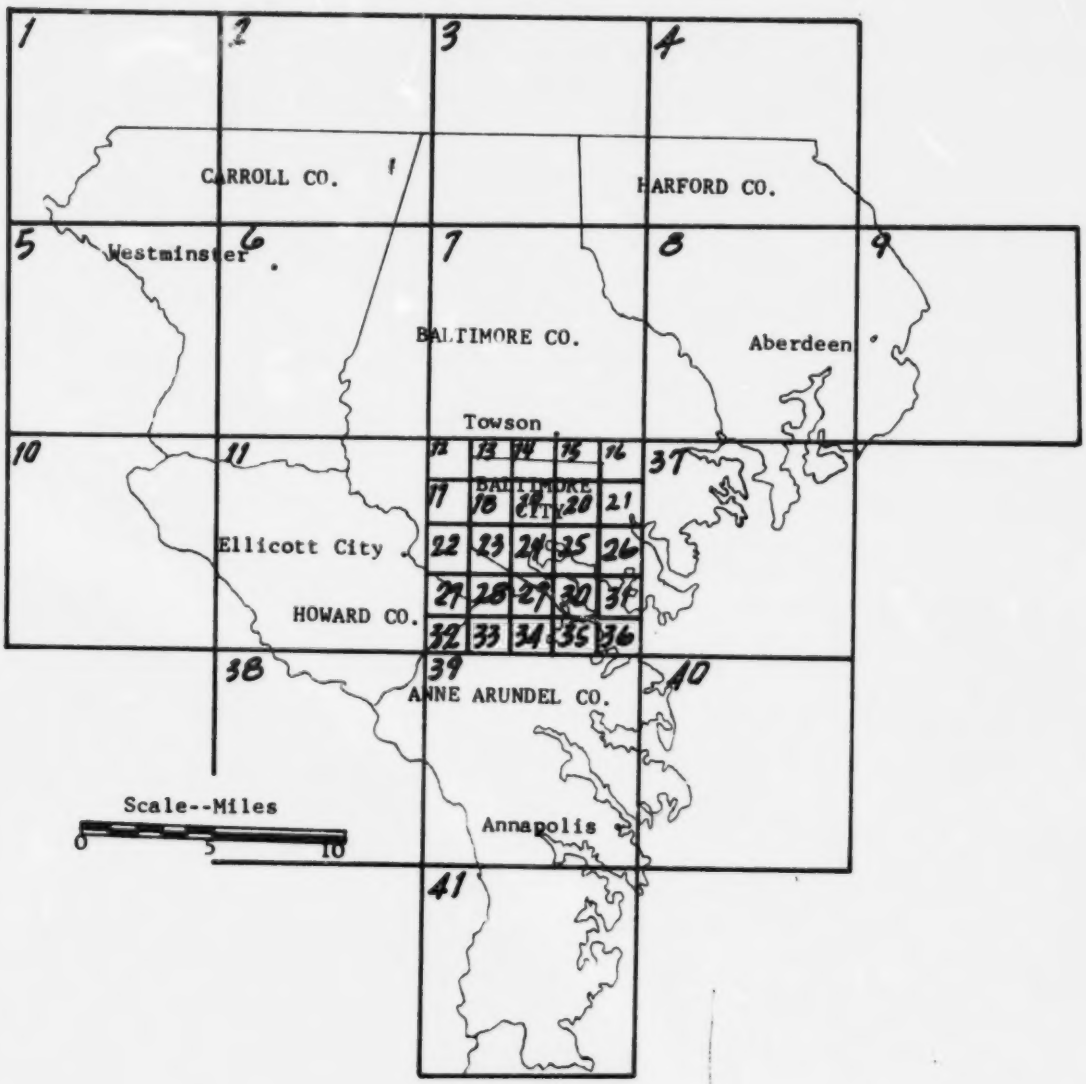


Figure 4. Emissions Inventory Grid Zones

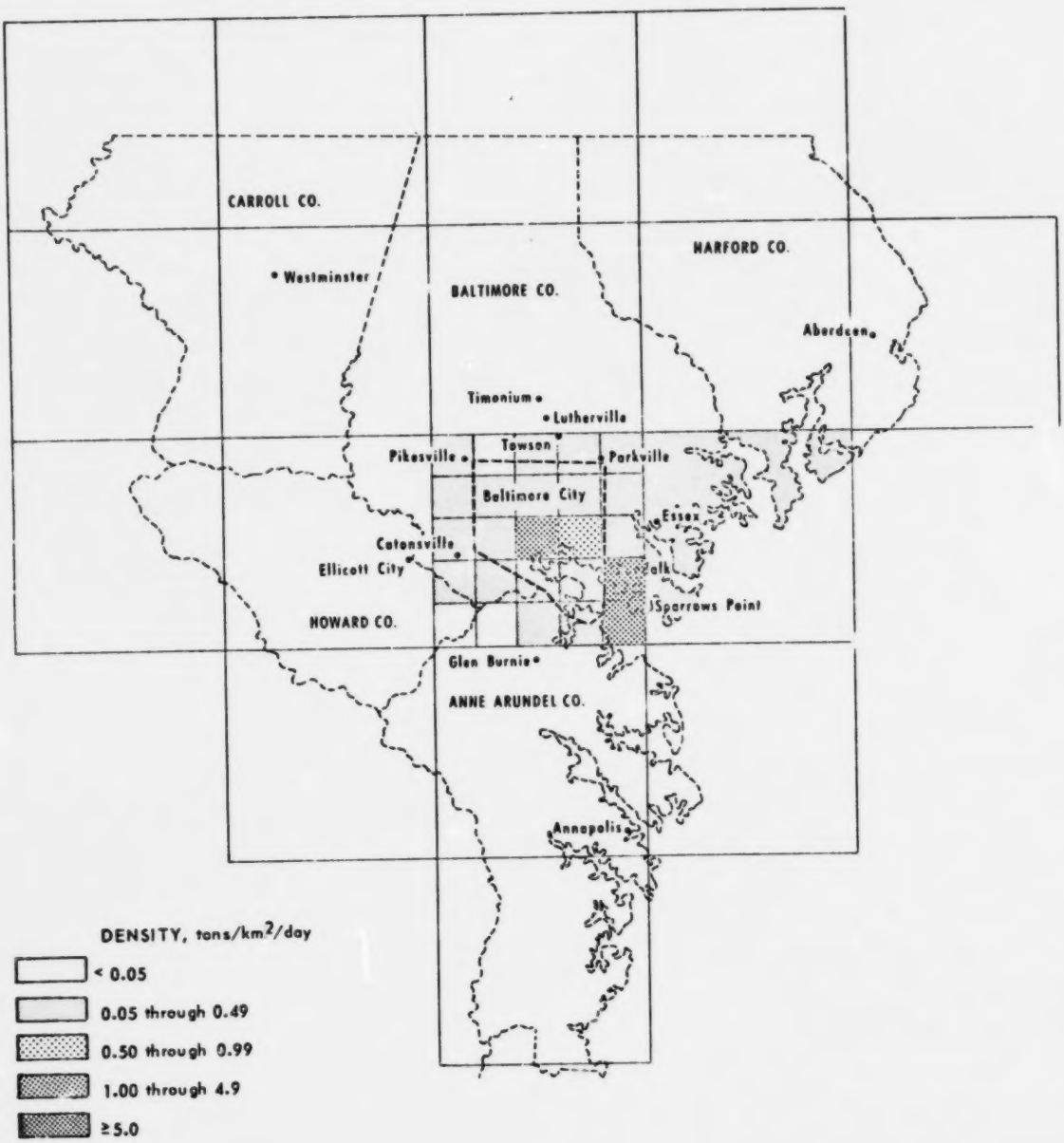


Figure 5.
Density of particulate emissions from all sources – winter.

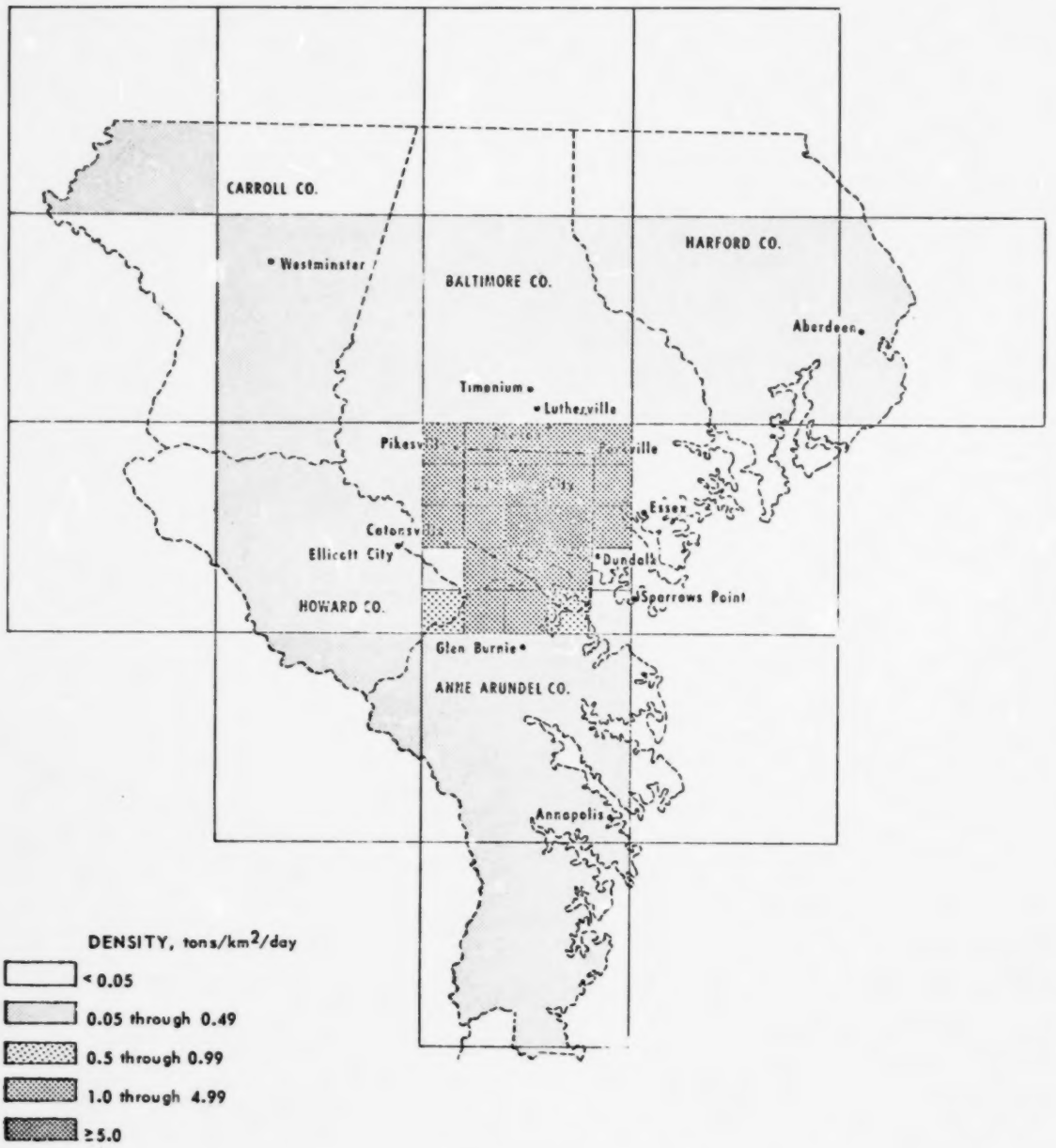


Figure 6.

Density of carbon monoxide emissions from all sources – calendar.

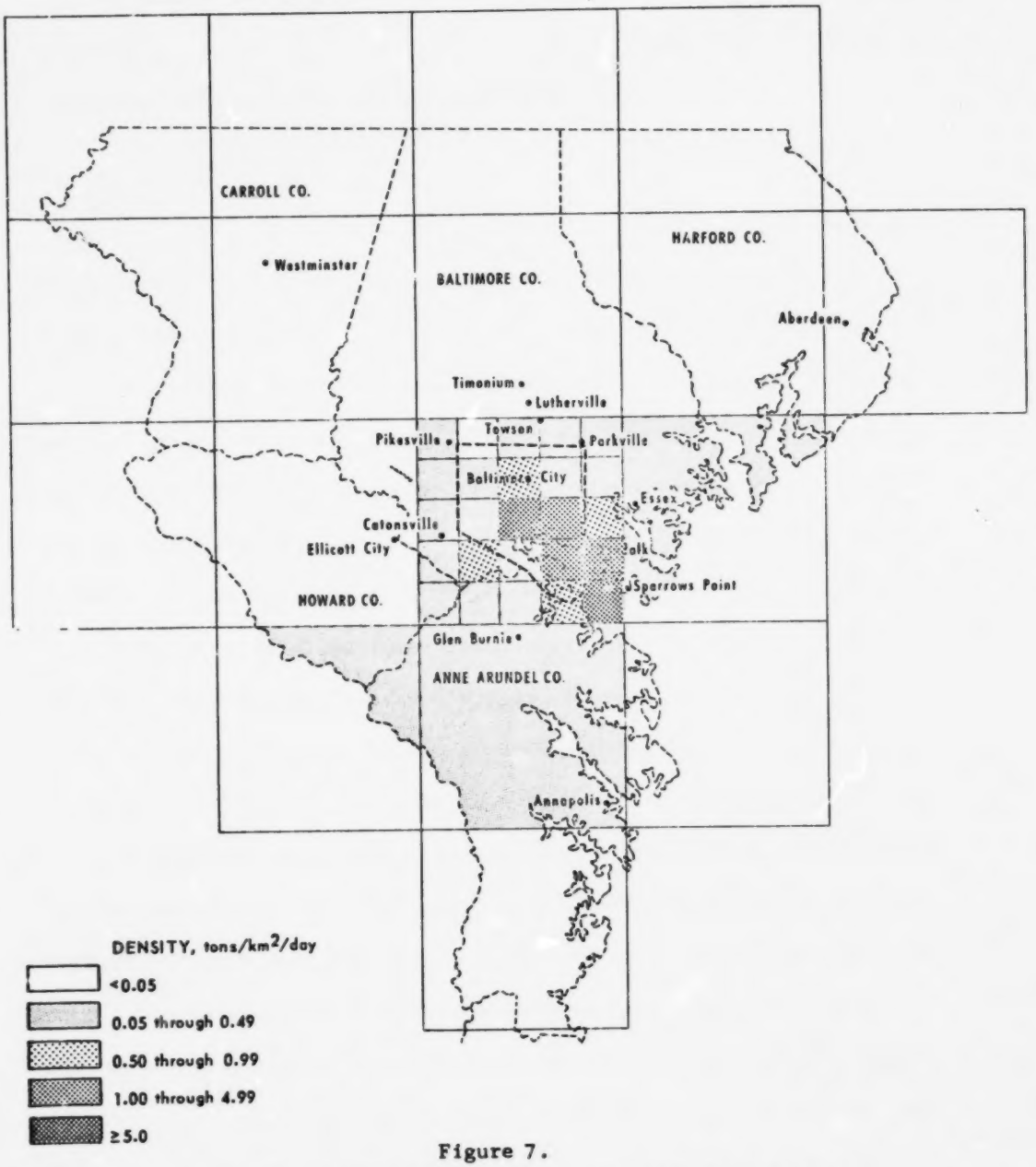


Figure 7.

Density of sulfur oxide emissions from all sources – winter.

Emission densities for SO_X and particulates are given for the winter months since emissions are greater in winter than in summer. The general pattern of emission densities for each of the three pollutants is closely related to the pattern of urbanization in the Baltimore study area.

Major point sources contributing to the air pollution problem are shown in Figure 8.

AIR QUALITY ANALYSIS

The geographical distribution of pollutant sources illustrates the core of the problem area. It does not, however, elucidate the extent of the influence of pollution sources on the people and property located outside the highly urbanized portion of the Baltimore area. A study of air quality levels known or estimated to occur is useful in determining the area affected by the pollution sources and thus subject to inclusion in the Air Quality Control Region. Such analysis can be based directly on air sampling data in those instances where the sampling program covers a large enough area and has been in existance long enough to provide reliable patterns of air quality throughout the region under study. Since such comprehensive air quality data rarely exists, it becomes necessary to develop estimates of prevailing air quality. Diffusion modeling is a technique by which such estimates can be made based on the location and quantity of pollutant emissions and on meteorological conditions. Topography is reflected in the results of the model, but only to the extent that it influences meteorological conditions.

The diffusion model was applied for each of the three pollutants

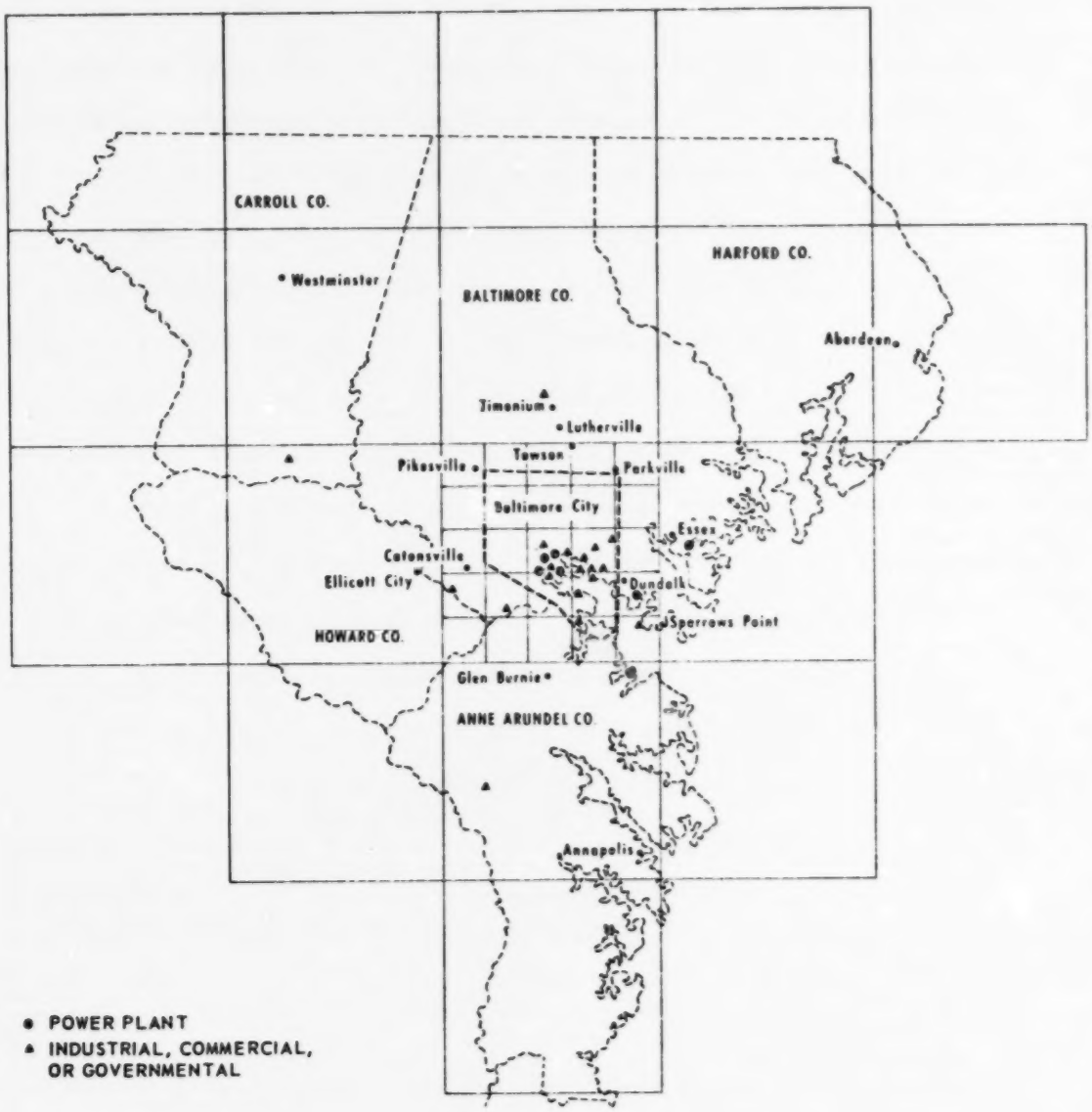


Figure 8.

Major point sources of emissions of any pollutant greater than 1000 tons per year.

for an average summer day, winter day, and annual day. Figure 3 and Table 2 show the meteorological data required to apply the model for each of the three average days. Figure 3 shows the percent frequency of occurrence of wind direction from 1951 through 1960 in Baltimore for summer, winter, and annual conditions. The wind speed and direction data used in the diffusion model were considered representative of the prevailing wind patterns throughout the Baltimore area. Since the Martin-Tikvart model[1] used in this study attempts to show long-term rather than episodic air quality conditions, only average emissions and long-term meteorology are considered. If episodic data (i.e., data related to more stagnate but less frequent occurrence) were used to aid in delineating a region boundary, the region would be unnecessarily large. Even the "smaller" region defined on the basis of mean concentrations will undoubtedly encompass the area of maximum concentration upon which a reduction plan is to be developed.

The mixing depths for the time periods are averages of the morning and afternoon values as shown in Table 2; these data were

Table 2. Average Mixing Depths for Baltimore Area by Season

Season	Mixing Depths, meters		
	Average Morning	Average Afternoon	Average, Morn. and Afternoon
Winter (Dec.,Jan.,Feb.)	600	900	750
Summer (June,July,Aug.)	420	1860	1140
Annual (Four Seasons)	520	1435	975

obtained from tabulations prepared by the National Weather Records Center (ESSA). Combined with wind data, these data are used in the

diffusion model to assess the spatial distribution of concentrations of suspended particulates, sulfur oxides, and carbon monoxide.

The air pollution concentration contours produced by the diffusion model are theoretical in nature and are not meant to show exact concentration levels. In this report, the contour maps are used as a guide to help indicate the areas most affected by pollutant emissions in the study area. Initial concentration values from the model output are generally adjusted to conform with limited measured data; the shapes of the isopleths, however, are not changed.

Suspended Particulates

Figure 9 shows adjusted theoretical suspended particulate concentrations for the winter months (December, January, and February). The isopleths were produced by the diffusion model and are based on average winter meteorological eonditions and winter particulate emissions from the study area.*

The original values of the isopleths differed slightly from measured suspended particulate concentrations in the area. A multiplying factor of 1.2 was determined to be appropriate and was applied to the computed contour values to produce those of Figure 9. The shapes of the contours were not changed.

The contours are drawn down to concentrations of 40 $\mu g/m^3$, the assumed background level for the area surrounding Baltimore.** The area within the background-level contour is considered the area

* Had emissions from the Washington, D.C. area been included in the diffusion model, the contours would have been elongated in a south-westerly direction, and values would have been higher particularly towards the south-west.

** The average winter concentrations of six non-urban stations in Maryland, Deleware, Pennsylvania, and Virginia (1957-1968) is 40.6 $\mu g/m^3$.

Figure 9. Theoretical adjusted winter suspended particulate concentrations.

most affected by particulate emissions in the Baltimore area. Parts of Anne Arundel, Harford, Howard, Kent, and Baltimore Counties, and all of Baltimore City lie within this contour and should therefore be considered for inclusion in the Air Quality Control Region.

Sulfur Oxides

Figure 10 shows winter diffusion model estimates of sulfur oxides. Comparison with Baltimore data from the National Air Surveillance Network (December, January, and February, 1966-1969) indicated that the model over-estimated concentrations in the core of the study area. Diffusion model concentration values were adjusted by a factor of 0.60 to conform with measured values of SO_X.

SO_X concentrations of 0.01 ppm and greater are shown in Figure 10. The 0.01 ppm diffusion model isopleth has been used in previous region designation as a guide in determining the size of the region. This value is considered to be close to background levels. Parts or all of the following jurisdictions are encompassed by the 0.01 ppm contour: Baltimore City, Baltimore County, Harford County, Kent County, Anne Arundel County, and Howard County.

Carbon Monoxide

Gasoline-powered motor vehicles are the main contributors of carbon monoxide in most urban areas. In the Baltimore area, transportation sources account for more than 96% of all carbon monoxide emissions. Figure 11 shows the main transportation arteries in the study area. Freeways, highways, and other arteries are considered major source areas of carbon monoxide emissions.

Figure 12 shows diffusion model contours based on all CO

Figure 10. Theoretical adjusted winter sulfur oxides concentration contours.

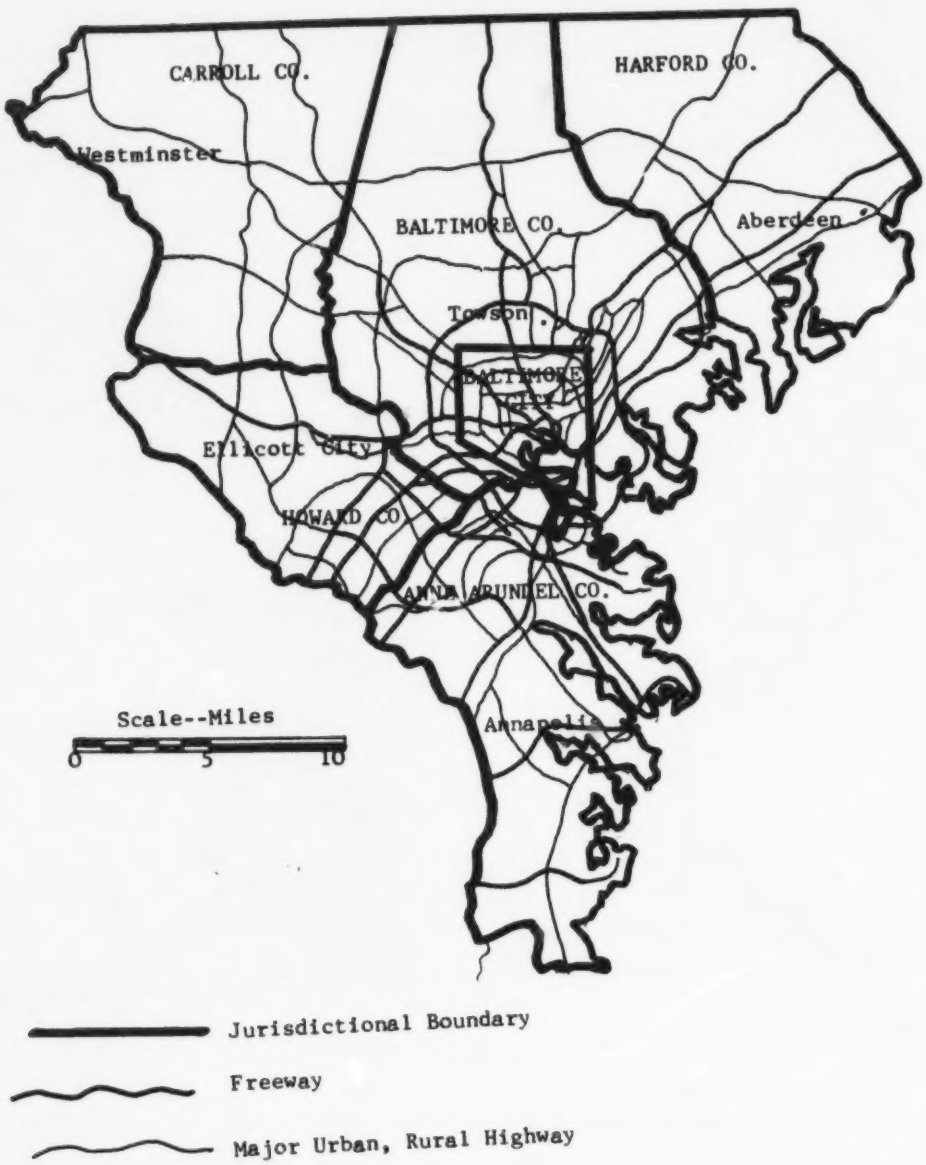


Figure 11. Major Traffic Arteries

Figure 12. Theoretical relative carbon monoxide contours (annual average).

emissions in the area. These contours are presented as theoretical relative rather than absolute. Highest CO concentrations are found in Baltimore City where traffic density is greatest.

EVALUATION OF URBAN FACTORS

INTRODUCTION

A number of urban factors are relevant to the problem of defining air quality control region boundaries. First, the location of population is an important consideration, since human activity is the ultimate cause of air pollution, and humans are the ultimate victims. The population growth pattern is another important consideration, since an air quality control region should be designed not only for the present but also for the future. The location of industrial activity and the industrial growth pattern are relevant considerations for similar reasons. Political and jurisdictional considerations are important also, since the 1967 Air Quality Act envisions regional air pollution programs based on cooperative efforts among many political jurisdictions. The following discussion of urban factors will present these considerations as they apply to the Baltimore area.

POPULATION

Figure 13 and Table 3 display present population and population densities in Baltimore and surrounding areas.[4] About 915,000 people reside within Baltimore City, which represents almost half (46%) of the population in the study area (Baltimore City, and the Counties of Harford, Baltimore, Carroll, Howard, and Anne Arundel). About 43% of the area population live in Baltimore and Anne Arundel Counties, leaving about 11% residing in the three counties of Howard, Carroll, and Harford. Baltimore City has the highest population density with over 11,700 residents per square mile. Baltimore and Anne Arundel

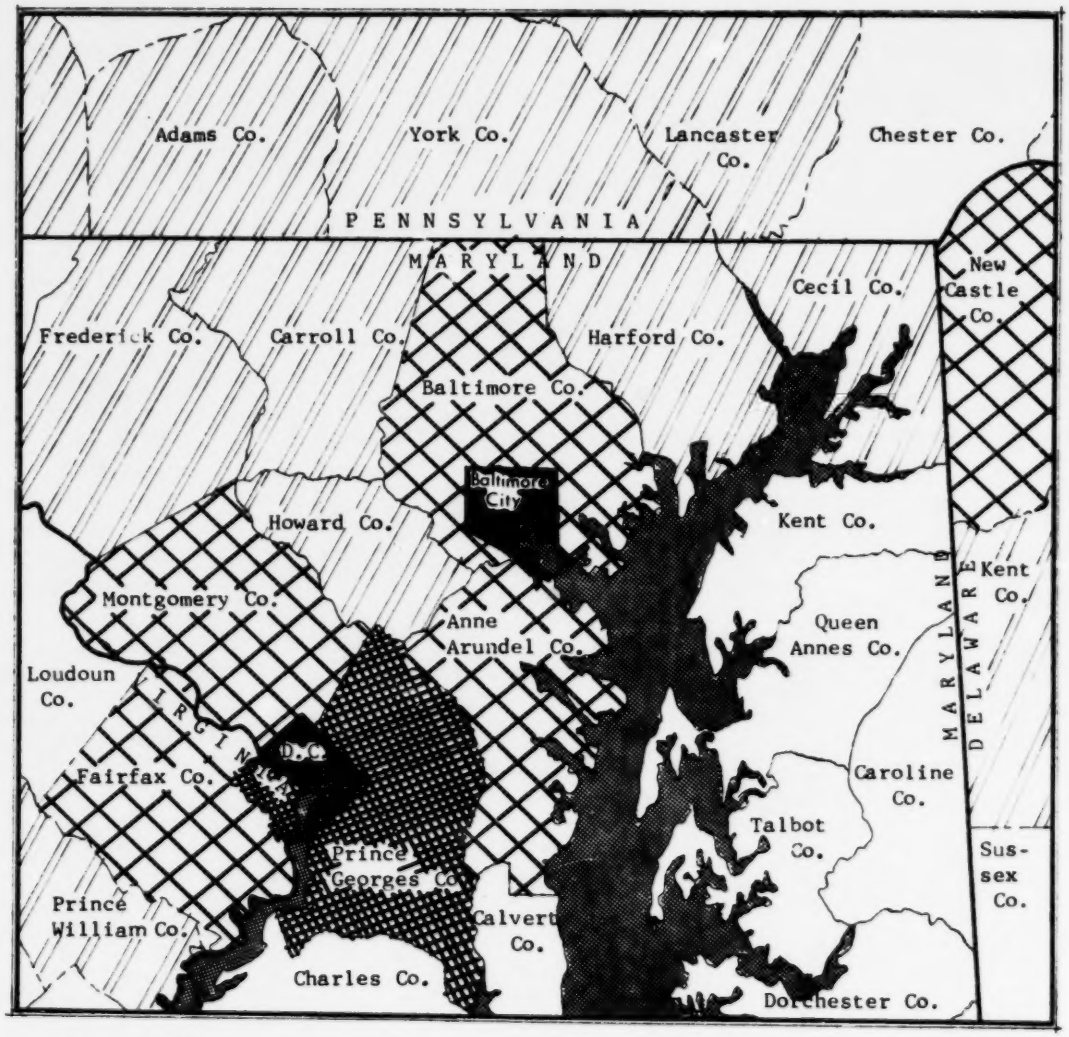


Figure 13. 1968 Population Density

Table 3. Population and Employment Data for the Baltimore Area

Jurisdiction	Area $mi.^2$	Population 1968	Pop. Density 1968 $res./mile^2$	Population 1985	Pop. Density 1985 $res./mile^2$	Add. res. per $mile^2$ 1968-'85
Anne Arundel Co.	423	270,000	639	535,300	1,270	631
Baltimore City	78	915,000	11,720	1,020,200	13,100	1380
Baltimore Co.	598	590,000	986	1,078,100	1,800	814
Carroll Co.	456	64,000	140	90,000	193	53
Harford Co.	453	103,500	338	168,000	370	142
Howard Co.	251	52,500	209	205,400	819	610

Counties follow with 986 and 639 residents per square mile, respectively. Carroll, Harford, and Howard Counties have less than 300 residents per square mile.

Population growth during the next 15 years is also represented in Table 3 and in Figure 14.[5] The greatest absolute growth is expected to take place in Baltimore City with over 1300 additional residents per square mile. Baltimore, Anne Arundel, and Howard Counties will follow with growths of over 600 additional residents per square mile. Population growth in Harford and Carroll Counties will be slight. Both will experience growth of less than 150 additional residents per square mile.

In sum, the major portion of present population is centered in Baltimore City and its suburbs in Baltimore and Anne Arundel Counties. Major growth is expected to occur in these two counties and in Howard County in the direction of Washington D.C.

INDUSTRY

Two methods are used ot indicate the location of manufacturing activity, one for the present and one for the future. The first method is based on the density of people employed in manufacturing firms. According to 1963 data[4], Figure 15, Baltimore City has by far the highest density of manufacturing employees with 1040 per square mile. Baltimore County ranks second with 107 manufacturing employees per square mile. The other four counties in the study area have relatively low densities with less than 25 manufacturing employees per square mile.

The second method attemps to show the probable location of industry in 1985 by the suggested land use plan developed by the

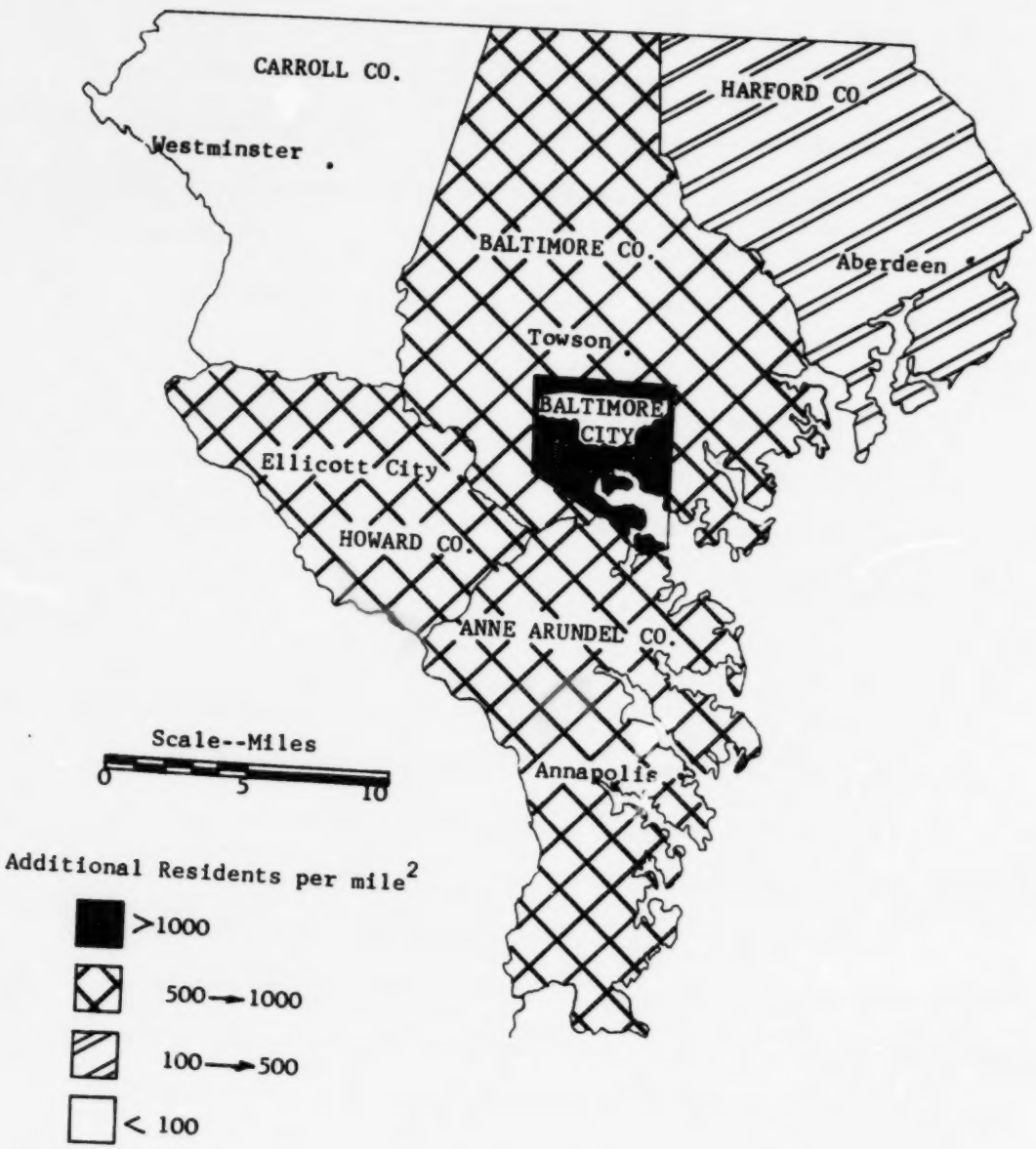


Figure 14. Population Growth in Baltimore Study Area from 1968 to 1985 Expressed in Absolute Terms.

Scale--miles
0 5 10 15 25

State Boundary
County Boundary (Maryland)
County Boundary (Pennsylvania, Virginia, Deleware)

Figure 15. Manufacturing Employment Density (1963)

Manufacturing Employees per square mile

>1000
100→1000
50→100
10→50
< 10

Baltimore Regional Planning Council. Figure 16 shows those areas which are at present or expected to be in the future devoted to industrial land use. At present, the largest industrial establishments are located around the Patapsco Waterfront in south-east Baltimore City and County. The other counties are spotted with industrial activity. Major expansion is expected to take place between I-95 and the Bay in Harford and Baltimore Counties, around Back River, in Marley Neck, along I-83 north of the Beltway, around Friendship Airport, and in the corridor between Baltimore and Washington near the proposed I-95 and the Baltimore-Washington Parkway.

REGIONAL PLANNING IN THE BALTIMORE AREA

Regional planning in the Baltimore area is handled primarily by the Regional Planning Council. The area covered by the Council is called the Regional Planning Area and includes all of Anne Arundel, Baltimore, Carroll, Harford, and Howard Counties, and Baltimore City. The Council was created in 1963 by the Maryland General Assembly to succeed the Baltimore Regional Planning Council which was then an informal subsiderary of the State Planning Department. The activities of the Council are numerous and include preparing and adopting a Suggested General Development Plan for the Regional Planning Area, conducting research and data gathering, advising governmental units on the relationship of local, regional, State, and Federal planning activities, preparing standards for building and subdivision-control ordinances, preparing methods for establishing budgets for public projects, and contracting with governmental units to provide specialized planning services. By virtue of its membership,

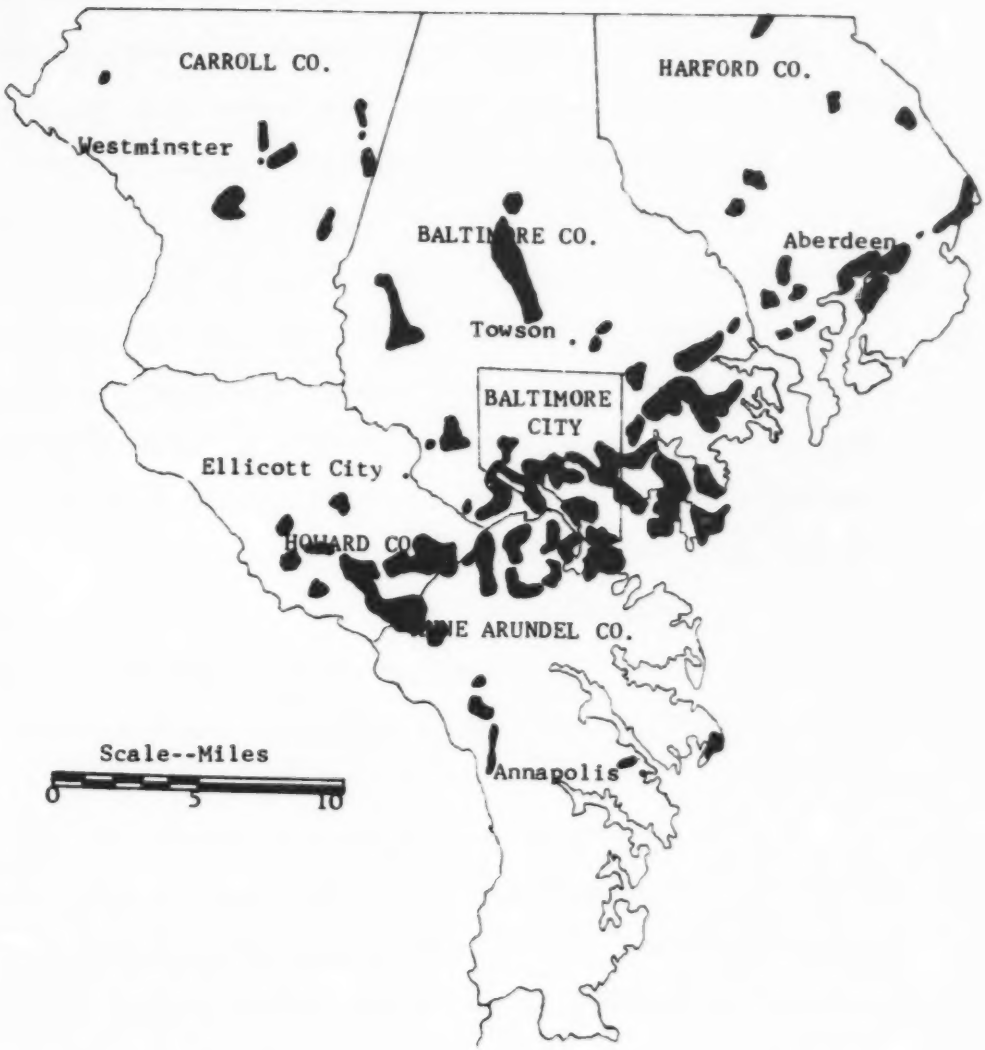


Figure 16 . Industrial Areas in 1985 (based on the Suggested General Development Plan--Baltimore Region)

the Regional Planning Council is also the effective Council of Governments for the Region.

AIR POLLUTION PROGRAMS

Under the Marvland Air Quality Control Act of 1967, responsibility for jurisdiction over emissions and ambient air quality is vested in the State Department of Health. Regulations have been adopted and approved by the Board of Health and Mental Hygiene. The Act also specifies that the State of Maryland be divided into six Air Quality Control Areas. The Board of Health and Mental Hygiene established the areas as shown in Figure 17. (only parts of five of the six areas are shown in the figure). Area IV (Montgomery and Prince Georges Counties) is also part of the Washington D.C. National Capital Interstate Air Quality Control Region which was formally designated by the Secretary of Health, Education, and Walfare in 1968. Regulations governing the control of air pollution have been adopted for all six areas. These regulations control open burning, visible emissions, particulate matter emissions, gas, vapor, and odor emissions.

Local governments may enact ordinances covering the same subject matter as the State statute. The local ordinance, however, must not be in conflict with the State law and must be at least as stringent as the State law on the same subject matter.

Local air pollution control programs in the Baltimore area include those of Baltimore County, Anne Arundel County, and Baltimore City. In Baltimore County the Board of Health is responsible for the control of air pollution. The Division of Environmental Health of the

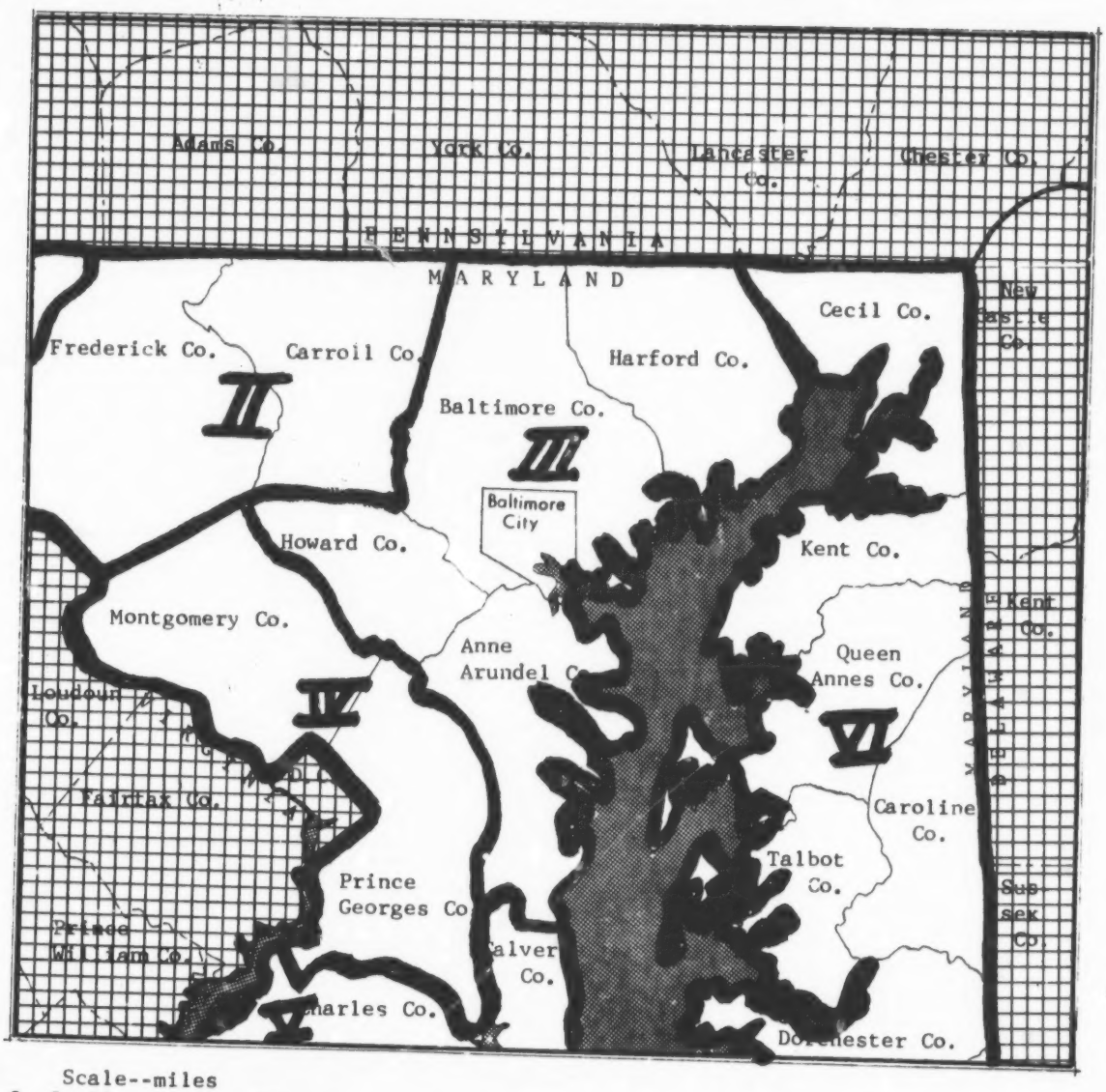


Figure 17. State of Maryland Air Quality Control Areas

Anne Arundel County Department of Health is responsible for carrying out studies and control for Anne Arundel County. Both Baltimore and Anne Arundel Counties will soon adopt regulations which will be at least as stringent as the State's regulations. Control of air pollution in Baltimore City is the responsibility of the Baltimore City Health Department under Ordinances 358, 169 (Smoke Control), and 1062 (Open Burning).

THE PROPOSED REGION

Subject to the scheduled consultation, the Secretary, Department of Health, Education, and Welfare, proposes to designate an air quality control region for the Baltimore area, consisting of the following jurisdictions in Maryland:

Anne Arundel County
Baltimore City
Baltimore County
Harford County
Howard County

As so proposed, the Metropolitan Baltimore Intrastate Air Quality Control Region would consist of the territorial area encompassed by the outermost boundaries of the proposed jurisdictions. The proposed Region is illustrated in Figure 18. Figure 19 locates the Region in relation to the rest of Maryland, the surrounding states and existing air quality control regions.

DISCUSSION OF PROPOSAL

As proposed, the Region boundaries coincide with the boundaries of the Air Quality Control Area III established by the State of Maryland. In general, state-defined air basins do not automatically qualify as air quality control regions. However, the Air Quality Act of 1967 requires region boundaries to take into account existing jurisdictions, among other factors. Clearly, a state-designated basin is an important jurisdictional consideration. Therefore, this study of the geographic extent of the air pollution problem indirectly evaluates the suitability of the state-designated area as a geographic basis of attack on the problem. As discussed below,

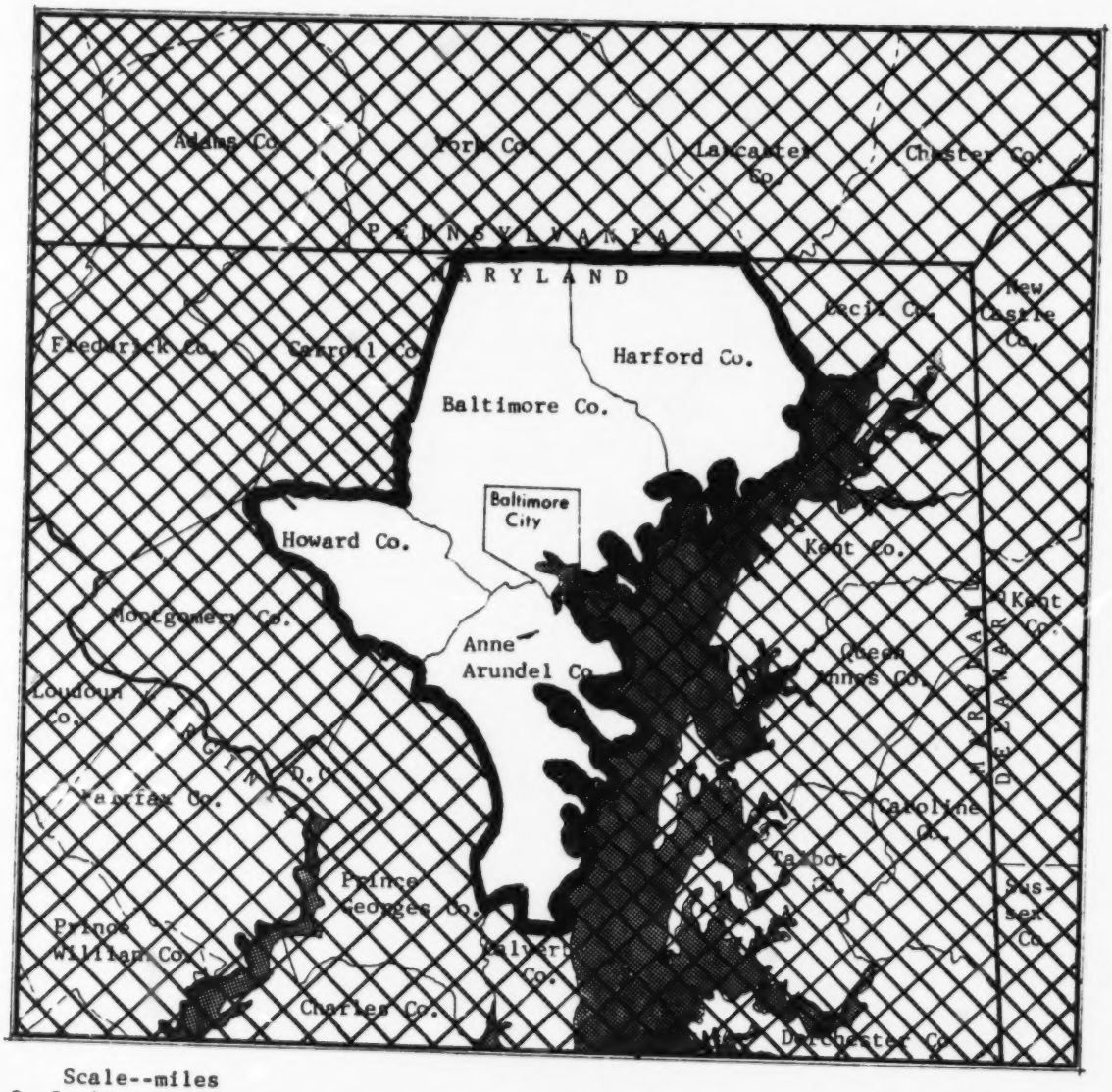


Figure 18. Proposed Metropolitan Baltimore Intrastate Air Quality Control Region.

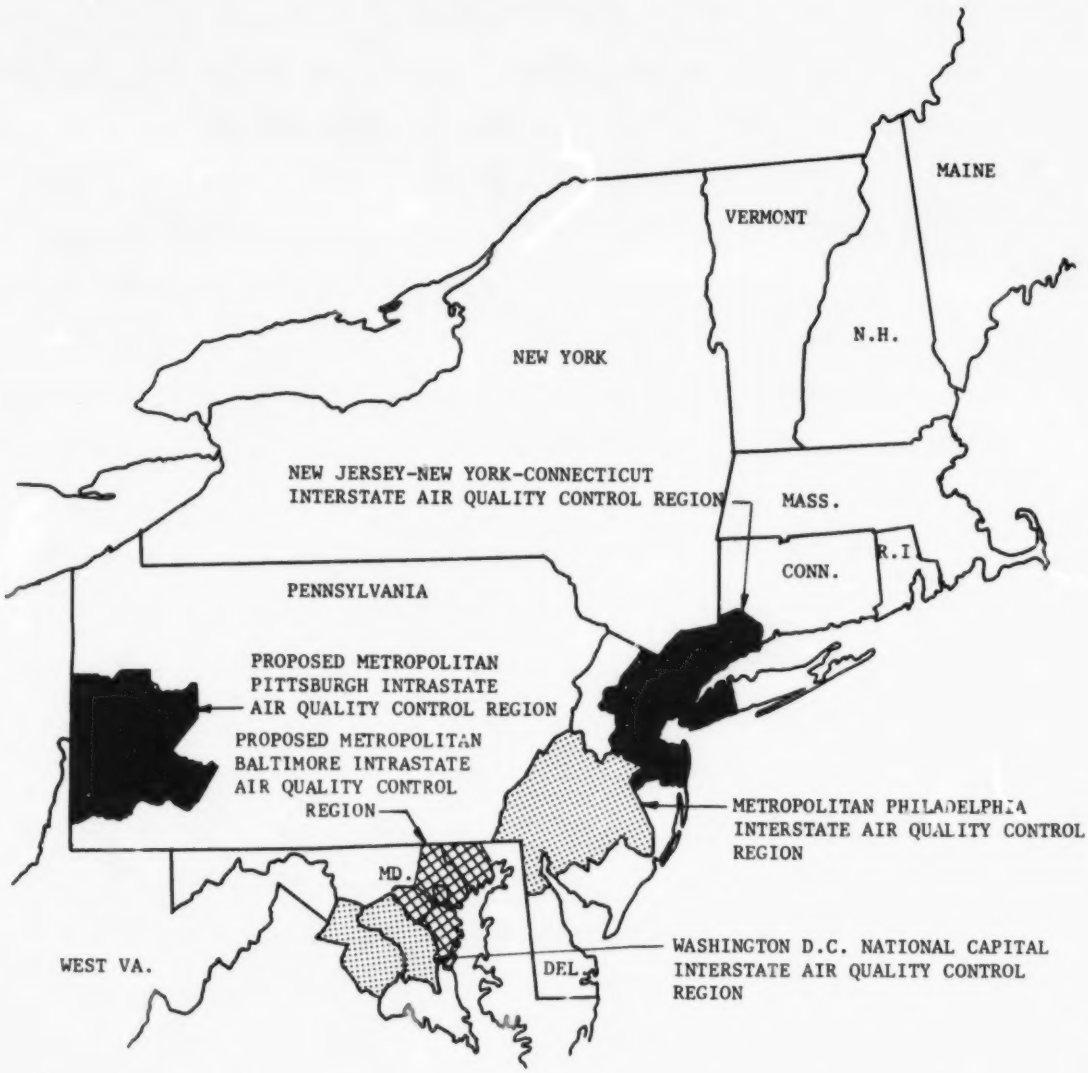


FIGURE 19. RELATIONSHIP OF PROPOSED METROPOLITAN BALTIMORE INTRASTATE AIR QUALITY CONTROL REGION TO SURROUNDING AREAS.

Area III satisfies the three requirements for air quality control region boundaries, although certain marginal areas on the outer periphery of the Area should be re-examined periodically and included in the Region if warrented by future population and industrial growth.

To be successful, an air quality control region should meet three basic conditions. First, its boundaries should encompass most pollution sources as well as most people and property affected by those sources. Second, the boundaries should encompass those locations where industrial and residential development will create significant air pollution problems in the future. Third, the boundaries should be chosen in a way which is compatible with and even fosters unified and cooperative governmental administration of the air resources throughout the region. The "Evaluation of Engineering Factors" (discussion beginning with Page 12) discussed the first of these conditions, and the "Evaluation of Urban Factors" (Page 30), the second and third.

The first consideration--that most air pollution sources and receptors lie within the Region boundaries--is satisfied by the proposed Region. The emission inventory located point sources emitting over 1000 tons per year of any single pollutant. The emission density maps indicate that Baltimore City and the surrounding suburbs in Baltimore and Anne Arundel Counties have the highest emission densities of sulfur oxides and particulates. Emissions of carbon monoxide are more wide spread since the automobile is the main contributor.

The adjusted theoretical concentrations produced by the diffusion model showed that five counties and Baltimore City are most affected by emissions of SO_X and particulates from sources

within the study area. Harford, Baltimore, Howard, and Anne Arundel, and Kent Counties, and Baltimore City are either partially or totally affected by winter concentrations of 40 $\mu g/m^3$ suspended particulates and 0.01 ppm SO_x. Highest CO concentrations occur in Baltimore City, southern Baltimore County, and northern Anne Arundel County.

The proposed Region also encompasses most of the people living in the area--over 96% of the study area population. Over 52% of the population of the State of Maryland reside within the boundary of the proposed Region (another 28% live within the boundaries of the Metropolitan Washington D.C. National Capital Interstate Air Quality Control Region (Montgomery and Prince Georges Counties) bringing the total percentage of the State's population within air quality control regions to over 80%).

The second consideration is directed towards future population and industrial expansion. By 1985, Baltimore City is expected to have grown by over 1350 additional residents per square mile. Baltimore, Anne Arundel, and Howard Counties, respectively, will follow Baltimore City in population growth with 500-1000 additional residents per square mile. Harford and Carroll Counties will grow by less than 150 additional residents per square mile from 1968 to 1985. All counties will experience industrial growth in the next fifteen years; areas most heavily affected will probably be Baltimore City and County, Harford, and Howard Counties.

The third objective is directed towards governmental administration in the area. Regional planning is handled by the Regional Planning Council whose jurisdiction covers Baltimore City, and the Counties

of Anne Arundel, Baltimore, Carroll, Harford, and Howard. By virtue of its membership, the Regional Planning Council is also the Council of Governments of the Region. The same jurisdictions, less Carroll County, make up Air Quality Control Area III set up by the State Board of Health and Mental Hygiene. At present, Carroll County's inclusion in the Air Quality Control Region seems unnecessary since it is sparsely populated, has little population growth potential for the next 15 years, and is mostly rural. However, since Carroll County is part of the Regional Planning Area, and therefore is part of the overall General Development Plan for the Planning Area, it should be watched carefully in the next few years and made a part of the Air Quality Control Region if local and State officials feel it is a part of the Baltimore regional air pollution problem.

As is true of most efforts to draw boundaries around an area to differentiate it from its surroundings, there is always a likelihood of boundary conditions existing or developing. In the case of air quality control regions, such a boundary condition would exist where sources of pollution on one side of the Region boundary affect in some real way air quality on the other side of the boundary. Relocating the boundary would only rarely provide relief from this condition. The solution is to be found in the way in which control efforts are implemented following the designation of an air quality control region. Consonant with the basic objective of providing desirable air quality within the problem area being designated as an air quality control region, the implementation plan that follows the designation should have provisions for the control of

sources located close to but beyond the region boundaries. The level of control for such sources should be a function of, among other factors, the degree to which emissions from sources cause air quality levels to exceed the standards chosen for application within the Air Quality Control Region.

In summary, the Region proposed is considered on the whole to be the most cohesive and yet inclusive area within which an effective regional effort can be mounted to prevent and control air pollution in the Baltimore area.

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